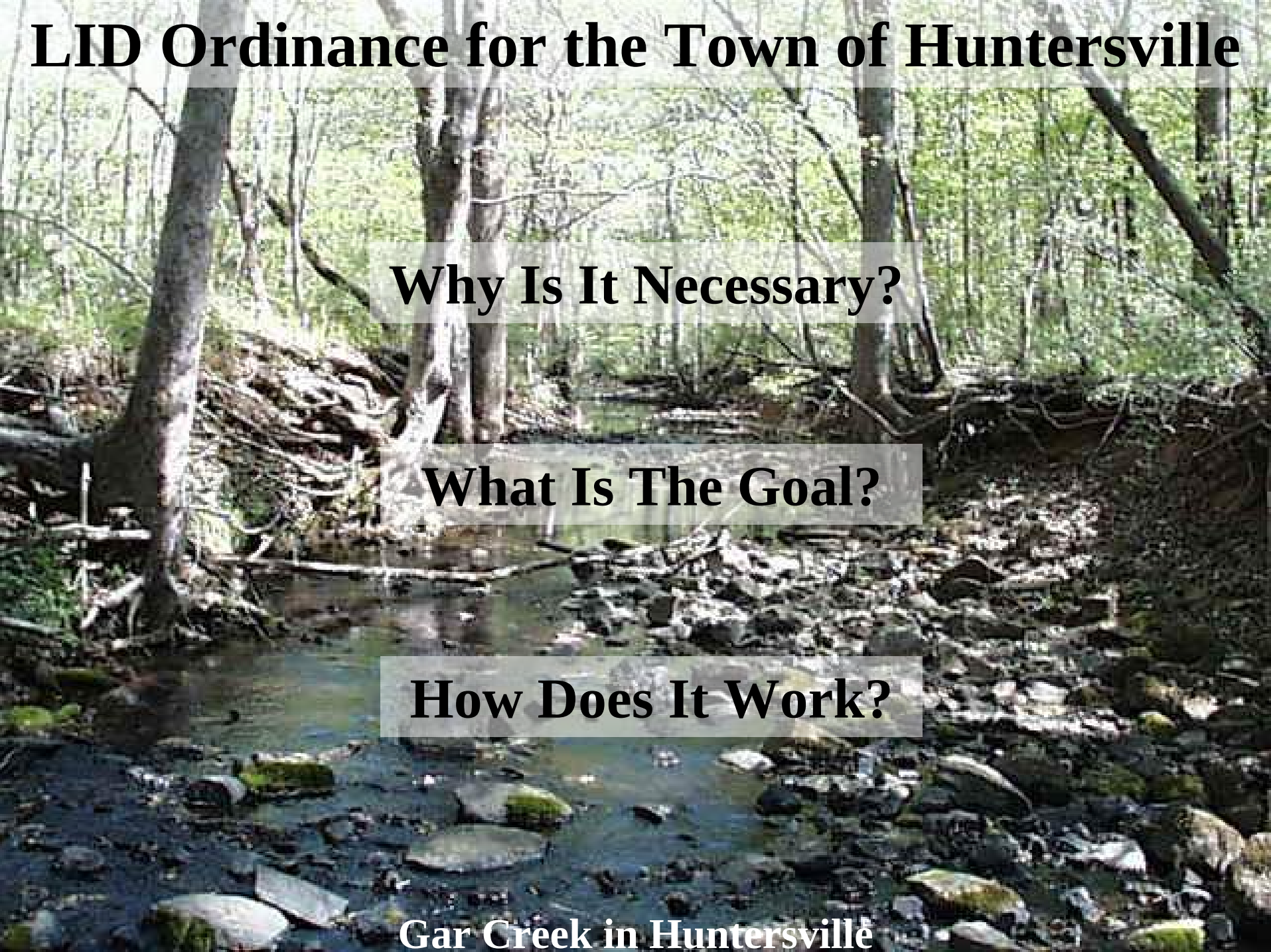
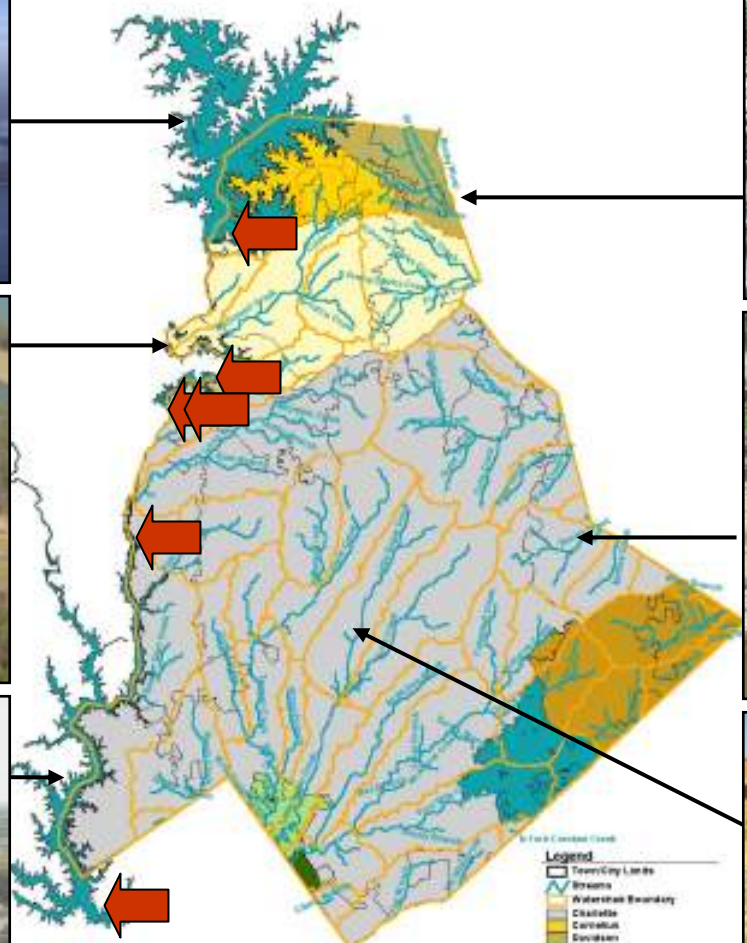
LID Ordinance for the Town of Huntersville



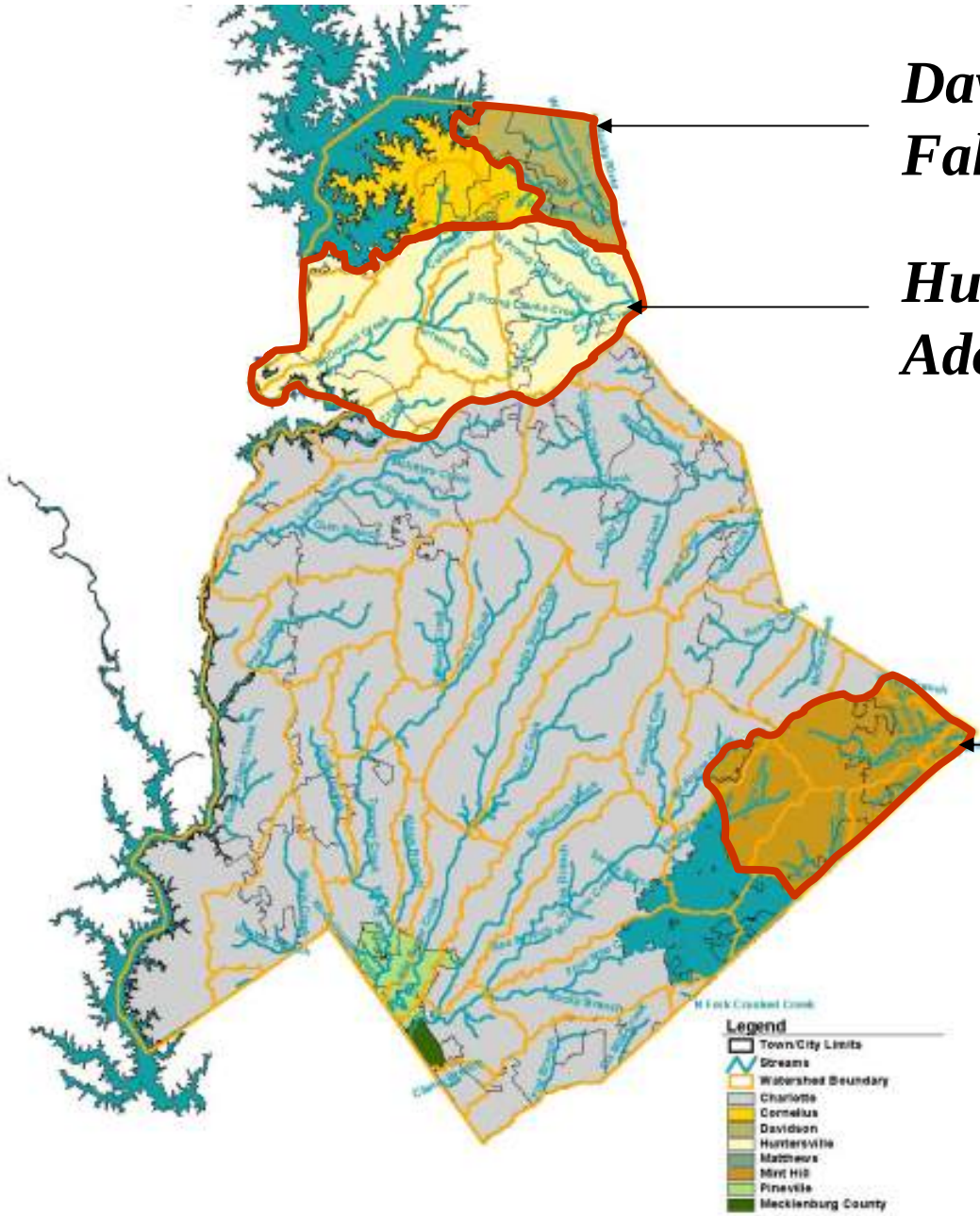
Gar Creek in Huntersville

Waters of Mecklenburg



Our Most Precious Natural Resource

LID Ordinance Adoption in Mecklenburg County



Davidson Ordinance
Fall 2004

Huntersville Ordinance
Adopted February 2003

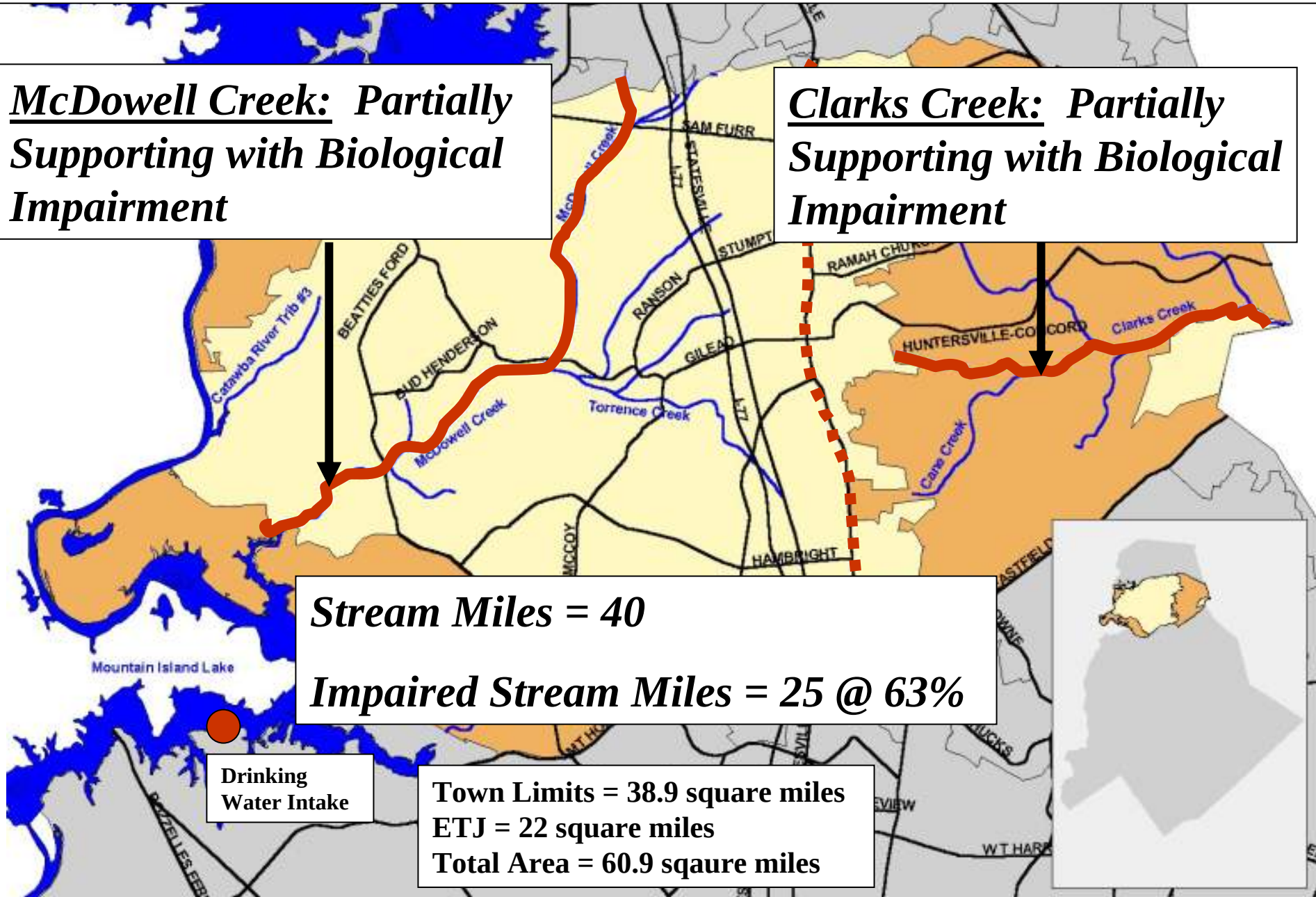
Mint Hill Ordinance
Fall 2004

Huntersville Jurisdiction

Effective February 2003

<u>McDowell Creek:</u> Partially Supporting with Biological Impairment

<u>Clarks Creek:</u> Partially Supporting with Biological Impairment



Stream Miles = 40

Impaired Stream Miles = 25 @ 63%

Town Limits = 38.9 square miles
ETJ = 22 square miles
Total Area = 60.9 sqaure miles

Increased Development Results in Declining Water Quality Conditions

The population in Mecklenburg County has increased by 36% from 1990 to 2000 with the greatest growth occurring in outlying areas of the Towns where the population has increased by 76% over the 10 year period.

McDowell Creek, Huntersville

McDowell Creek Water Quality Model

Developed by Tetra Tech, Inc. – Private consulting firm

Objectives of the Modeling Effort:

Quantify the negative impacts

Identify causes

Predict future impacts

Develop solutions

Storm Water Runoff Pollutants

Bacteria

Sediment

Heavy Metals

Pesticides

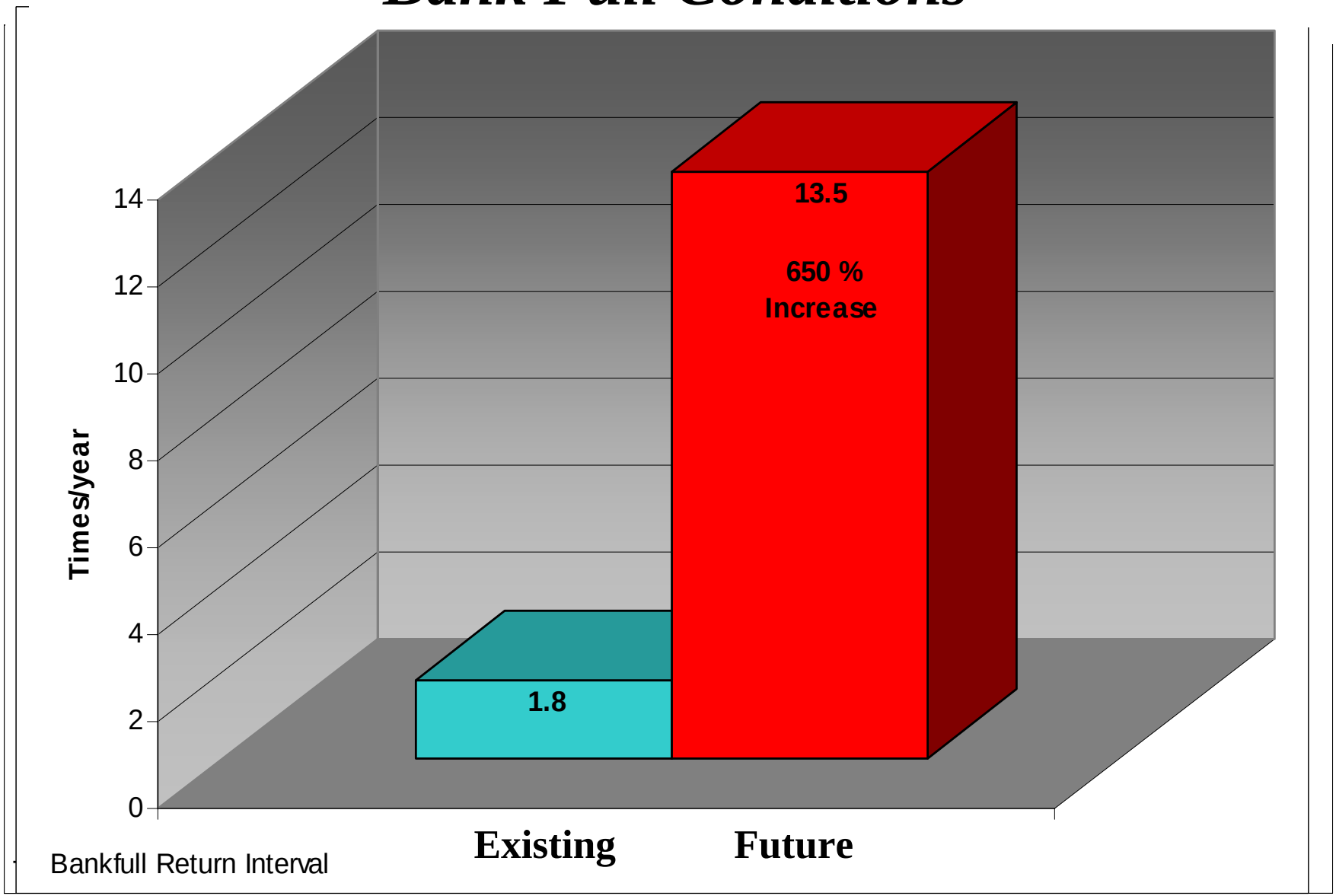
Fertilizers

Petroleum Products

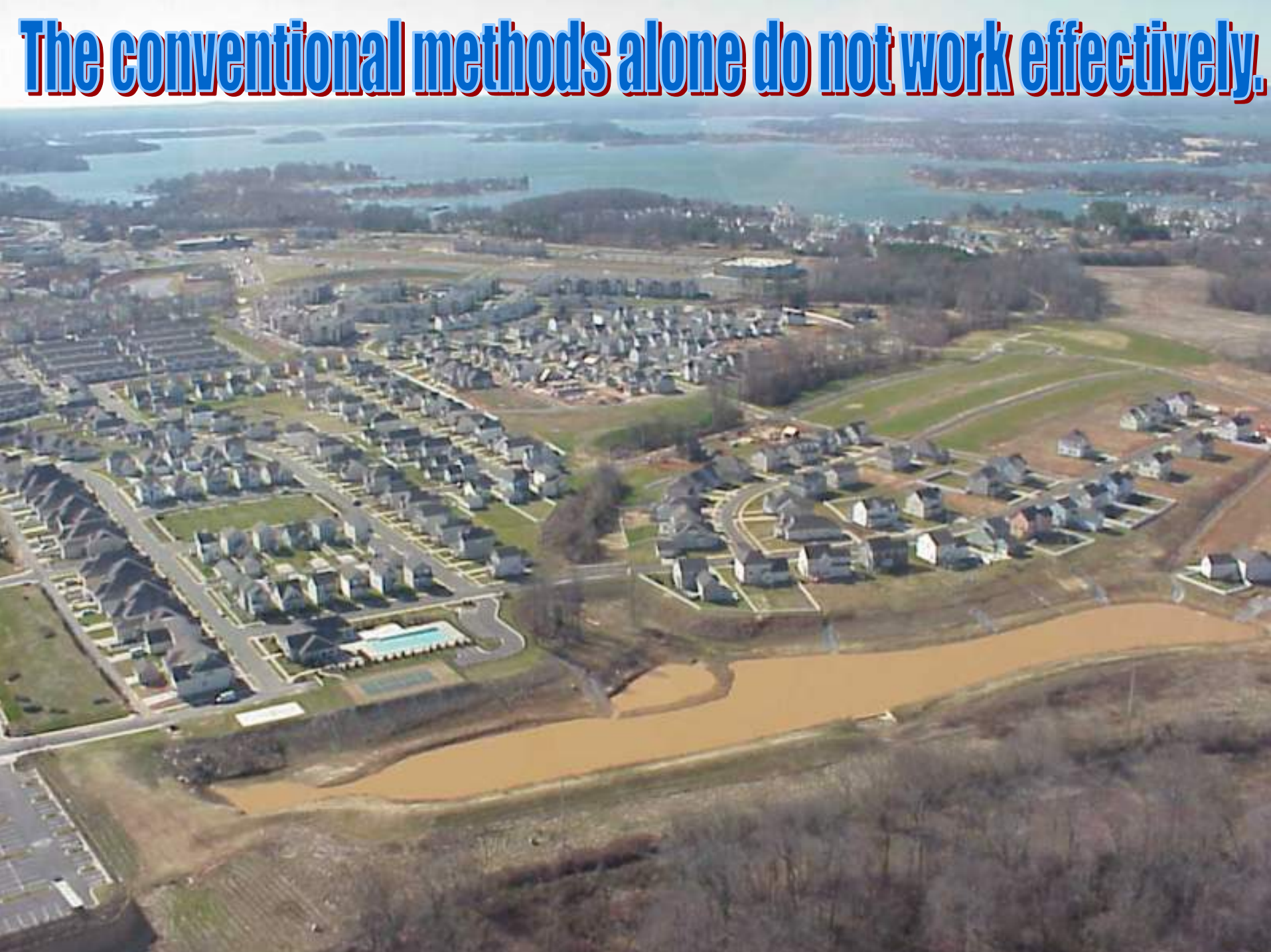

Channel erosion due to storm water runoff volumes and rates.

Modeling Results

Bank Full Conditions



The conventional methods alone do not work effectively.



Goal Established by Huntersville Elected Officials

To establish storm water management requirements and controls to prevent surface water degradation by controlling discharges of pollutants as well as runoff volumes and rates.

Huntersville's LID Ordinance

Uses LID in combination with conventional techniques to control non-point source pollutants and mimic natural site hydrology through careful site planning and design focused on storing, infiltrating, detaining and retaining storm water runoff. Some of the basic principles of LID include:

- **Preserving as many trees as possible.**
- **Maintaining natural drainage patterns.**
- **Locating BMPs in soils with the highest permeability.**
- **Locating impervious areas on less permeable soils.**
- **Limiting clear cutting and mass grading.**

Performance Criteria

Goal of the Criteria

- Follow the guiding principle to “prevent surface water degradation” developed by Huntersville Town Board.
- In the simplest form, this means that existing conditions need to be maintained.
  - Use existing conditions as a guide to site design.
  - Mimic pre-development hydrology.

Performance Criteria:

1. BMPs must be designed to achieve 85% Total Suspended Solids (TSS) removal for the developed area of the site. All sites must employ LID practices to control and treat runoff from the first inch of rainfall.
2. LID alone or in combination with conventional practices must be used to control and treat the difference in runoff from pre versus post conditions for the 2-year 24-hour storm in the Rural and Transitional Zoning Districts. In other districts, the 1-year 24-hour storm applies.
3. Any temporary water quality storage pools must draw down in 48 to 120 hours.
4. The peak storm water runoff release rates leaving the site during post-construction conditions must be equal to or less than the pre-development peak storm water runoff release rates for the 2 and 10-year frequency, 24-hour duration storm event for all development exceeding 12% impervious area.
5. No one BMP can receive runoff from an area greater than 5 acres.

BMPs for Use in Huntersville (Tables 6.1 and 6.2, Pages 48 and 49)				
BMP	**Applicable Zoning Districts(1)**	**Applicable Performance Criteria (2)**	**Design Function(3)**	**Function(4) (WQ, VC, PC)**
Strategic Clearing & Grading	**U, T, R**	**3(a)**		**WQ, VC, PC**
Reduce Impervious Surfaces	**U, T, R**	**3(a)**		**WQ, VC, PC**
Bioretention (Rain Garden)	**U, T, R**	**3(a), 3(b)**	**Section 4.0**	**WQ, VC, PC**
Infiltration Trench	**U, T, R**	**3(a), 3(b)**	**Section 8.0**	**WQ, VC, PC**
Infiltration Swale	**U, T, R**	**3(a), 3(b)**	**Section 8.0**	**WQ, VC, PC**
Swales	**U, T, R**	**3(a)**	**Section 5.0**	**WQ, VC**
Swales with Outlet Control	**T, R**	**3(a), 3(a)**	**Section 5.0**	**WQ, VC, PC**
Vegetative Filter Strips & Buffers	**U, T, R**	**3(a)**	**Section 7.0**	**WQ, PC**
Dry Well, Cistern & Rainbarrel	**U, T, R**	**3(b)**		**WQ, VC, PC**
Porous Paving	**U, T, R**	**3(b)**		**WQ, VC**
Curb & Gutter Elimination	**R**	**3(b)**		**WQ, PC**
Rooftop Storage	**U, T, R**	**3(b)**		**VC, PC**
Wet Pond	**U, T, R**	**3(b), 3(d)**	**Section 1.0**	**WQ, VC, PC**
Extended Dry Pond	**T, R**	**3(b), 3(d)**	**Section 6.0**	**VC, PC**
Storm Water Wetlands	**T, R**	**3(b)**	**Section 2.0**	**WQ, VC, PC**
Sand Filter	**T, R**	**3(a)**	**Section 3.0**	**WQ, VC, PC**

(1) Applicable Zoning Districts: These are the Zoning Districts where the BMP can be used including U = Urban; T = Transitional; R = Rural.
(2) Applicable Performance Criteria: These are the Performance Criteria Section numbers (see Section 3) that the BMP can be used to satisfy.
(3) Design Function: All BMP designs are contained in the N.C. Department of Environment & Natural Resources, Storm Water Best Management Pratices, April 1999
(4) Functions: These are the dominate functions that the BMPs perform including WQ = Water Quality; VC = Volume Control, PC = Peak Control.

85% TSS Removal

- 85% TSS Removal
  - North Carolina Requirement
  - Applies to developed areas of a Site (no disincentive for open space, buffers, tree save, etc.)
  - Water Quality Benefit: Vastly reduces upland sediment load
    - Preserve In-stream Habitat
    - Preserve Cove usability
    - Reduce Phosphorus

First 1 Inch of Rainfall

- All sites must employ LID practices to control and treat runoff from the first inch of rainfall.
  - Water Quality Benefit: 90% of pollutants are delivered in the runoff from the first 1inch of rainfall.
    - Reduces Temperature
    - Nutrients
    - Fecal Coliform
    - Protects Channel
      - Erosion
      - Habitat Destruction

BMPs for Use in Huntersville (Tables 6.1 and 6.2, Pages 48 and 49)				
BMP	**Applicable Zoning Districts(1)**	**Applicable Performance Criteria (2)**	**Design Function(3)**	**Function(4) (WQ, VC, PC)**
Strategic Clearing & Grading	U, T, R	3(a)		WQ, VC, PC
Reduce Impervious Surfaces	U, T, R	3(a)		WQ, VC, PC
Bioretention (Rain Garden)	U, T, R	3(a), 3(b)	Section 4.0	WQ, VC, PC
Infiltration Trench	U, T, R	3(a), 3(b)	Section 8.0	WQ, VC, PC
Infiltration Swale	U, T, R	3(a), 3(b)	Section 8.0	WQ, VC, PC
Swales	U, T, R	3(a)	Section 5.0	WQ, VC
Swales with Outlet Control	T, R	3(a), 3(a)	Section 5.0	WQ, VC, PC
Vegetative Filter Strips & Buffers	U, T, R	3(a)	Section 7.0	WQ, PC
Dry Well, Cistern & Rainbarrel	U, T, R	3(b)		WQ, VC, PC
Porous Paving	U, T, R	3(b)		WQ, VC
Curb & Gutter Elimination	R	3(b)		WQ, PC
Rooftop Storage	U, T, R	3(b)		VC, PC
Wet Pond	U, T, R	3(b), 3(d)	Section 1.0	WQ, VC, PC
Extended Dry Pond	T, R	3(b), 3(d)	Section 6.0	VC, PC
Storm Water Wetlands	T, R	3(b)	Section 2.0	WQ, VC, PC
Sand Filter	T, R	3(a)	Section 3.0	WQ, VC, PC

(1) Applicable Zoning Districts: These are the Zoning Districts where the BMP can be used including U = Urban; T = Transitional; R = Rural.
(2) Applicable Performance Criteria: These are the Performance Criteria Section numbers (see Section 3) that the BMP can be used to satisfy.
(3) Design Function: All BMP designs are contained in the N.C. Department of Environment & Natural Resources, Storm Water Best Management Pratices, April 1999
(4) Functions: These are the dominate functions that the BMPs perform including WQ = Water Quality; VC = Volume Control, PC = Peak Control.

Residential Rain Gardens

Difference in Pre vs. Post

- Use LID (and Conventional) to Treat the difference in Pre vs. Post Runoff volume
  - In Rural and Transitional use the 2 Year 24 Hour Storm
  - Everywhere Else, use the 1 Year 24 Hour Storm

  - Water Quality Benefit: Added protection for Higher Intensity Development
    - Provides additional LID treatment
    - Provides additional channel protection
    - Phase II Stormwater reg. requirement (1 Year 24 Hour)

BMPs for Use in Huntersville (Tables 6.1 and 6.2, Pages 48 and 49)				
BMP	**Applicable Zoning Districts(1)**	**Applicable Performance Criteria (2)**	**Design Function(3)**	**Function(4) (WQ, VC, PC)**
Strategic Clearing & Grading	U, T, R	3(a)		WQ, VC, PC
Reduce Impervious Surfaces	U, T, R	3(a)		WQ, VC, PC
Bioretention (Rain Garden)	U, T, R	3(a), 3(b)	Section 4.0	WQ, VC, PC
Infiltration Trench	U, T, R	3(a), 3(b)	Section 8.0	WQ, VC, PC
Infiltration Swale	U, T, R	3(a), 3(b)	Section 8.0	WQ, VC, PC
Swales	U, T, R	3(a)	Section 5.0	WQ, VC
Swales with Outlet Control	T, R	3(a), 3(b)	Section 5.0	WQ, VC, PC
Vegetative Filter Strips & Buffers	U, T, R	3(a)	Section 7.0	WQ, PC
Dry Well, Cistern & Rainbarrel	U, T, R	3(b)		WQ, VC, PC
Porous Paving	U, T, R	3(b)		WQ, VC
Curb & Gutter Elimination	R	3(b)		WQ, PC
Rooftop Storage	U, T, R	3(b)		VC, PC
Wet Pond	U, T, R	3(b), 3(d)	Section 1.0	WQ, VC, PC
Extended Dry Pond	T, R	3(b), 3(d)	Section 6.0	VC, PC
Storm Water Wetlands	T, R	3(b)	Section 2.0	WQ, VC, PC
Sand Filter	T, R	3(a)	Section 3.0	WQ, VC, PC

(1) Applicable Zoning Districts: These are the Zoning Districts where the BMP can be used including U = Urban; T = Transitional; R = Rural.
(2) Applicable Performance Criteria: These are the Performance Criteria Section numbers (see Section 3) that the BMP can be used to satisfy.
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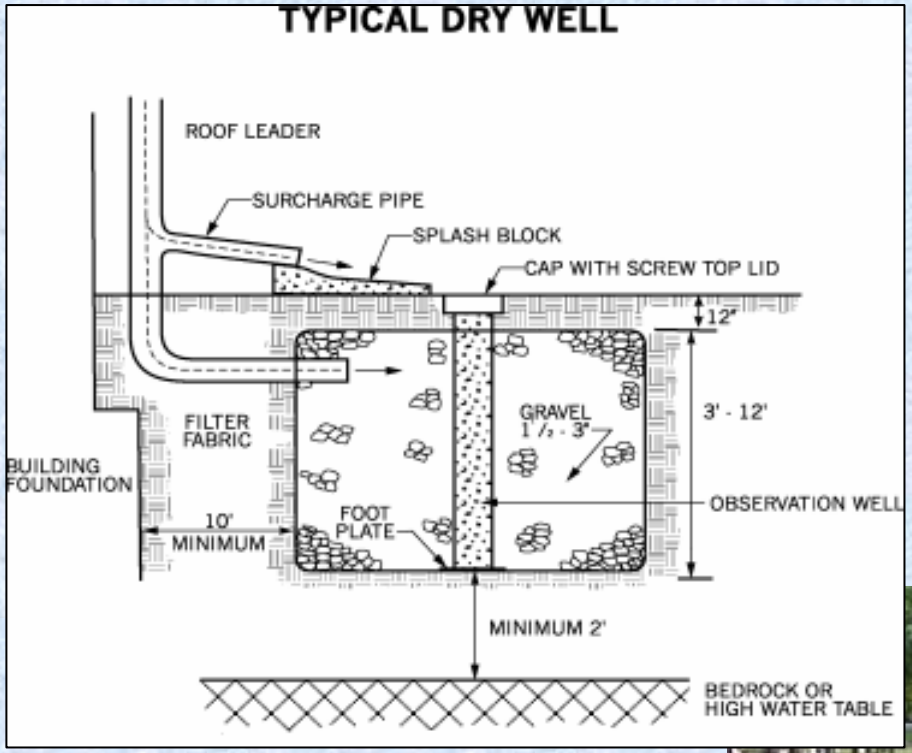
(4) Functions: These are the dominate functions that the BMPs perform including WQ = Water Quality; VC = Volume Control, PC = Peak Control.

Pre vs. Post: Dry Well



Pre vs. Post: Rain Barrels

Pre vs. Post: Wet Ponds

Pre vs. Post: Dry Ponds

Pre vs. Post: Wetlands

Draw Down

- Temporary ponds must draw down in 48 – 120 hours
  - Avoid standing water (mosquito breeding)
  - Long term standing water may damage plantings

  - Water Quality Benefit: Ensure water is released slowly
    - Channel Protection
    - Additional sediment protection (settling)

Peak Runoff Rates

- Peak storm water runoff rates shall be controlled for all development above 12% imperviousness (1 dwelling per acre).
  - Mimic the pre-development runoff rate for the 2-year 24 hour and 10-year 24 hour storms.

  - Water Quality Benefit: Added channel protection for larger storms.
    - Significant channel damage will be prevented.

BMPs for Use in Huntersville (Tables 6.1 and 6.2, Pages 48 and 49)				
BMP	**Applicable Zoning Districts(1)**	**Applicable Performance Criteria (2)**	**Design Function(3)**	**Function(4) (WQ, VC, PC)**
Strategic Clearing & Grading	U, T, R	3(a)		WQ, VC, PC
Reduce Impervious Surfaces	U, T, R	3(a)		WQ, VC, PC
Bioretention (Rain Garden)	U, T, R	3(a), 3(b)	Section 4.0	WQ, VC, PC
Infiltration Trench	U, T, R	3(a), 3(b)	Section 8.0	WQ, VC, PC
Infiltration Swale	U, T, R	3(a), 3(b)	Section 8.0	WQ, VC, PC
Swales	U, T, R	3(a)	Section 5.0	WQ, VC
Swales with Outlet Control	T, R	3(a), 3(a)	Section 5.0	WQ, VC, PC
Vegetative Filter Strips & Buffers	U, T, R	3(a)	Section 7.0	WQ, PC
Dry Well, Cistern & Rainbarrel	U, T, R	3(b)		WQ, VC, PC
Porous Paving	U, T, R	3(b)		WQ, VC
Curb & Gutter Elimination	R	3(b)		WQ, PC
Rooftop Storage	U, T, R	3(b)		VC, PC
Wet Pond	U, T, R	3(b), 3(d)	Section 1.0	WQ, VC, PC
Extended Dry Pond	T, R	3(b), 3(d)	Section 6.0	VC, PC
Storm Water Wetlands	T, R	3(b)	Section 2.0	WQ, VC, PC
Sand Filter	T, R	3(a)	Section 3.0	WQ, VC, PC

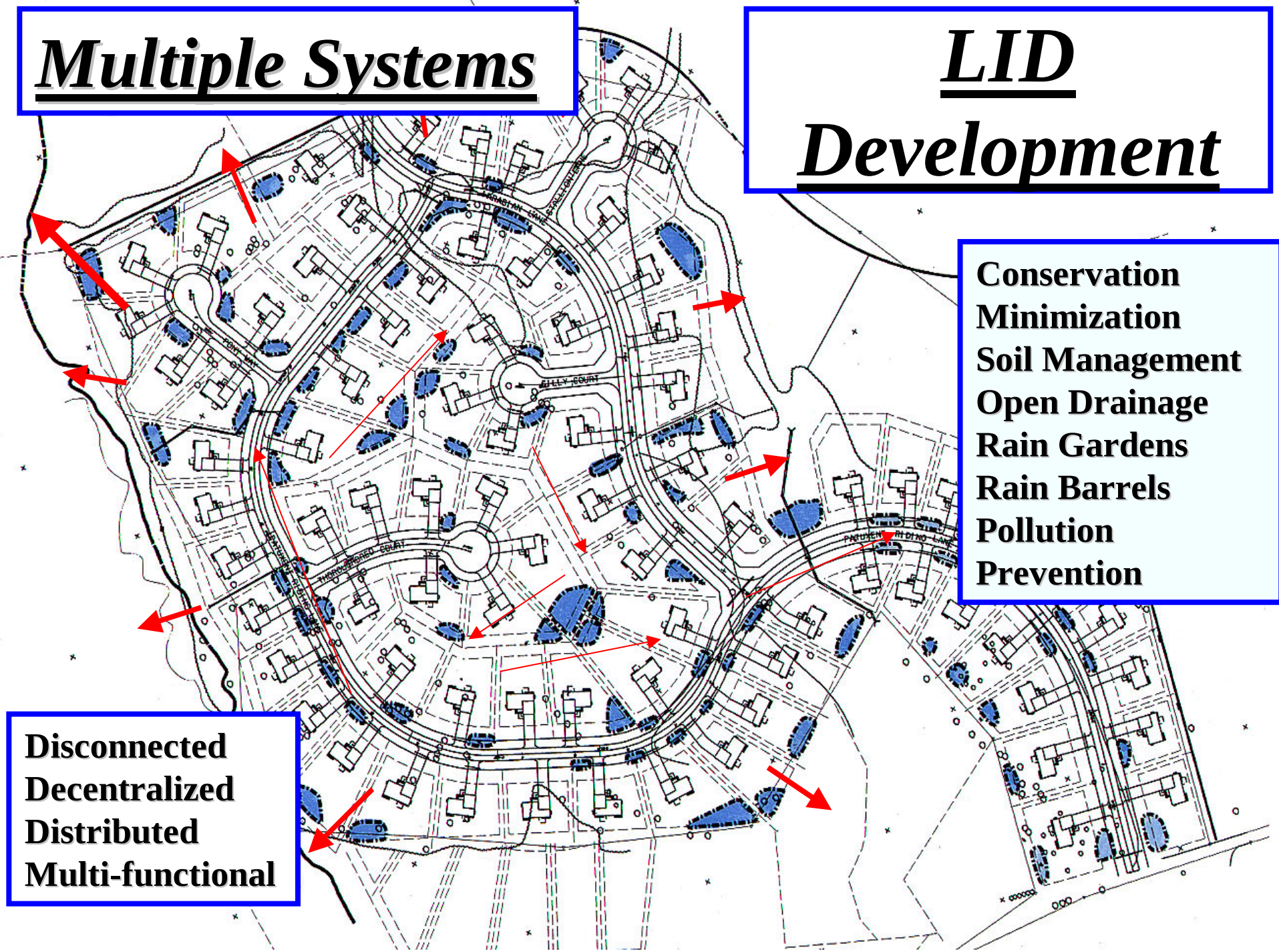
(1) Applicable Zoning Districts: These are the Zoning Districts where the BMP can be used including U = Urban; T = Transitional; R = Rural.
(2) Applicable Performance Criteria: These are the Performance Criteria Section numbers (see Section 3) that the BMP can be used to satisfy.
(3) Design Function: All BMP designs are contained in the N.C. Department of Environment & Natural Resources, Storm Water Best Management Pratices, April 1999
(4) Functions: These are the dominate functions that the BMPs perform including WQ = Water Quality; VC = Volume Control, PC = Peak Control.

Drainage Area

- No one BMP shall receive runoff from an area greater than five (5) acres.
  - However, the total drainage area from BMPs used in series (i.e., integrated) can exceed this five (5) acre maximum.
  - Water Quality Benefit: Redundancy in Storm Water Treatment System
    - In the event that a BMP fails, the entire treatment system is not compromised
    - Places BMPs closer to the source (micro instead of macro management of storm water)

Multiple Systems

LID Development



Conservation
Minimization
Soil Management
Open Drainage
Rain Gardens
Rain Barrels
Pollution
Prevention

Disconnected
Decentralized
Distributed
Multi-functional

Site Evaluation Tool (SET) is used to ensure performance criteria are met.

- “Simple” Water Quality and Stormwater Model
- Microsoft Excel Based
- Designed as a Planning/Scoping Level Tool
- Provides Plan Review Staff a Quick Assessment of the Environmental Impact of the Development
- Requires Developer/Engineer to Evaluate Essential Elements of a Site Early in the Process
  - Soils
  - Drainage
- Available at http://waterquality.charmeck.org
- click on Huntersville Ordinance

Site Evaluation Tool (SET)

Proposed Land Use/ Cover Data by DA						
	Project Areas (ft^2)	Unassigned Area (ft^2)	Drainage Areas (DA) associated with B			
			DA1	DA2	DA3	DA4
Pervious Areas						
Row Crops	0	0				
Pasture	0	0				
Forest	435,773	0	253,773	82,000	100,000	
Wetland	0	0				
Meadow	0	0				
Lawn	635,500	0	466,900	84,100	84,500	
Impervious Areas						
Residential & Light Industrial						
Rooftops	218,000	0	218,000			
Driveways & Parking Lots	70,850	0	70,850			
Other Impervious Area	32,700	0	32,700			
Road	153,700	0	153,700			
Sidewalk	53,000	0	53,000			
Commercial & Heavy Industrial						
Rooftops	0	0				
Parking Lot	0	0				
Other Impervious Area	0	0				
Road	0	0				
Sidewalk	0	0				
Storm Water Management Facilities						
Pond/Wetland	0	0				
All Other BMPs (except Forested Buffer)	36,000	0	36,000			
Total Area	1,635,523	0	1,284,923	166,100	184,500	
Proposed Drainage Area (DA) assignments match Proposed Land Use.						

Site Evaluation Tool (SET)

a. Click on a box to associate a BMP with a specific DA. BMPs should serve the entire DA.

b. Enter storage volume (if applicable) of BMP in acre-ft.

BMPs Applied to DA	DA1	DA2	DA3	---
Wet Pond	☐	☐	☐	☐
Dry Detention	☑	☐	☐	☐
Stormwater Wetland	☐	☐	☐	☐
Sand Filter	☐	☐	☐	☐
Bioretention (Rain Garden)	☑	☐	☐	☐
Enhanced Grass Swale	☐	☐	☐	☐
Grass Swale	☑	☐	☐	☐
Infiltration Trench	☐	☐	☐	☐
User-defined BMP (Sequential with other assigned BMPs)	☐	☐	☐	☐
Forested Buffer	☐	☑	☑	☐
Enter Buffer Width for each DA with Forested Buffer (feet):		140	140	
Percent of DA within treatment zone:		100.0%	100.0%	
Storage volume for 2 yr, 24 hr storm (acre-ft)	2.3			

Notes: Grass channels do not receive removal credit when used in combination with water quality dry swales.

Forested Buffers cannot be used with Wet Ponds, Dry Detention Basins, or Stormwater Wetlands in the same drainage area.

DEVELOPMENT PERFORMANCE ANALYSIS

MC Development Co.
Forest Lake Estates
109 Lot LID

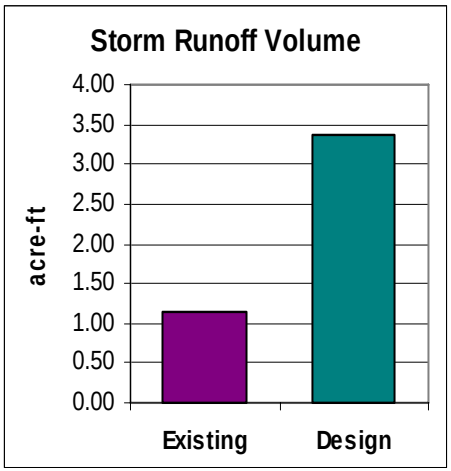
Land Use Summary

Total Site Area (acres)	36.72
Pre-development impervious percentage	1.0%
Post-development impervious percentage	33.7%

Annual Hydrology Summary

	Existing Landuse	Design without BMPs	Design with BMPs
Annual Surface Runoff (inches/yr)	2.32	13.91	7.43
Annual Infiltration (inches/yr)	12.00	7.08	13.57

2-year, 24-hour Storm Event Runoff Volume Summary



Storm Event Runoff Volume (acre-ft)	
Existing Landuse	1.16
Design without BMPs	3.38
2-yr, 24-hr BMP Storage	2.25
Target Storage [1]	2.22
Meets Goal?	YES

Maintenance

BMPs that are constructed on privately-owned land are maintained by a Property Owners Association. BMPs that are constructed on public land are maintained by the public.

Prior to the issuance of a CO, an approved Maintenance Covenant must be recorded that includes the identity of the responsible party and a maintenance plan.

Demonstration Project

700 N. Tryon St.
Charlotte, N.C.
1 acre parking lot

Original Detention Pond

Retrofitted Rain Garden